

# Comparative analysis of Light Gauge Framed Steel Structure with RCC Structure

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**Abstract** - For any construction project it is very important to complete the project within the estimated budget and time. In present scenario it is preferable for any construction project to complete in minimum time without compromising the strength and durability of building. Traditional technique of building construction like (RCC and Brick) is so much time consuming. But the growth rate of population is very high in India so we need some smart solution to meet the demand of buildings. The objective of this paper is to study the various components involved in smart solution for building construction and reduce the construction time as well as the cost. In addition as the research methodology of this research paper, we have collected the relatable data from various sources. After the collection we analysed this data and find out the major aspects and factors which are responsible for increasing the project cost. By the using this research we can increase the productivity and reduce the wastage, efficiently use the resources and reduce the overall cost of project.

**Key Words:** Cost control, Comparative study between RCC and LGSF, Time reduction in construction, Steel structure, LGFS.

## 1. INTRODUCTION

Reduction of cost of construction is a primary goal for construction industry. So there is need to study the smart solution and to identify cost/time reduction or cost control techniques for carrying construction projects effectively. The aim of the paper is to study the light gauge frame structure (steel structure) and comparative analysis of RCC structure and LGFS. We study the all aspects of the LGFS construction. We need to study the all aspects which affect the cost of construction from start to finish what is the process involved.

### 1.1 What is Light gauge steel framing structure system?

Light gauge framed system is type of the construction technology using the cold formed steel as the components or construction material. It can be used for the various

components of the building like floor system, roofing, wall etc. They can also be used as individual framing members such as studs, joists, headers, and truss members. So LGFS building could be the substitute of the traditional RCC/traditional building. For the finishing of these buildings structure cement board and gypsum board are used as per requirement after finishing these buildings are looks similar to RCC building sometimes we can't decide by visual observation.

## 1.2 Features of Light Gauge Steel Framing

- Steel sections galvanized with coating that are corrosion resistant. Steel will not shrink, swell, split or warp.
- High strength and low maintenance
- Construction time is much less, almost one third of the normal construction.
- All steel material are 100 % recyclable.
- Steel possesses the highest strength-to-weight ratio of any building material being used today.
- Steel framing is supplied with electrical and service holes pre-punched, so it reduced time on site for workers.
- Steel's light weight required smaller foundations and less excavation.

## 2. REVIEW OF LITERATURE

Alia O. M. Ahmed & Nigel d. P. Barltrop et al.(2017)<sup>1</sup> in this paper they have presented the seismic performance of the LGFS structure, these structures are very good performed under the seismic forces. Seismic forces or earthquake are very important factors which are considered in structure design of the building. The steel frame subjected to the lateral loading and slender steel can be adopting framing of portal without using shear panels so the result to be proved because they absorb the seismic forces due to the ductility. Another study is done on the cold formed steel and the selection of steel components Mohite M Prakash et al. (2015)<sup>[2]</sup> in this paper Has studied on cold formed steel through which he able to said that this steel section are good in their flexural strength and having good appearance. In this paper author given detailed study about cold formed steel

section and their comparative study using different codes through which they predict flexural strength of beams. Author concluded with comparison of comparative study on flexural strength of lipped channel section with experimental values. Mayankeshwar Singh et al.(2020)[3] presented the study on the topic of flexural behaviour of LGFS according to study steel LGFS is good in flexural behaviour. Sumit Shah et al.(2018)[4] in this paper some comparative analysis has done by author like cost ,time between RCC and Steel structure. Bhavin H. Zaveri et al.(2016)[5] review paper shows comparative study between RCC and Steel structure on the basis of the structural performance and fire resistance, cost, time, seismic resistance. Some of the study was done on the topic of sustainability and impact of the steel structure on the environment Alhalabi Zinah Shuman(2018)[6] LGFS are eco-friendly due to durability, recycling and the low construction site waste. One of the main key factors is the time consumption reduction and flexibility in non-bearing walls locations. As the population is growing exponentially, it is vital to meet the construction needs especially the residential and commercial or mixed used high-rise building.

### 3. METHODOLOGY

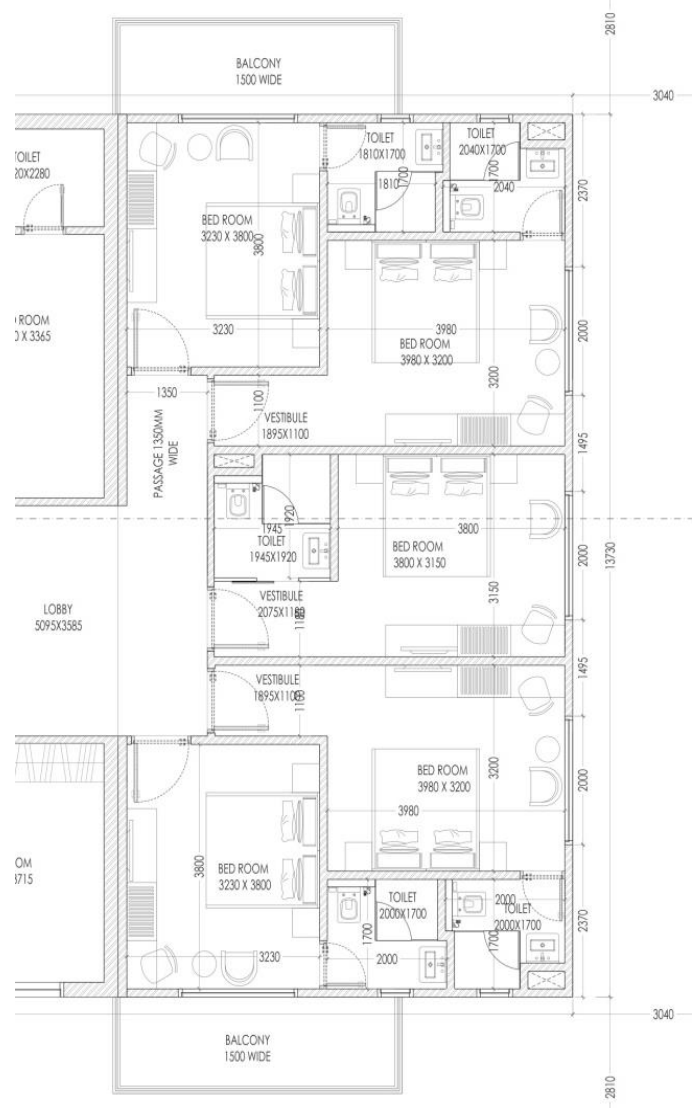
This study has conducted to identify the benefits over RCC structures all the aspect of the LGSF system will be studied. The method of data collection is secondary data collection. All the data will be collected from previously done research paper or construction related journals and books. We would also use some data which is published by the central govt. authorities like BMTPC, CPWD publication and state Govt published data. The collected data can be directly used in this paper or if required we will do calculation on the basis of these data. Related to my topic we need to do some comparative analysis on the basis of collected data. The data use for this paper will both quantitative and qualitative. In addition to the data processing the collected data are processed by using of computational tools like MS excel and MS project.

### 4. STUDY AREA

The project is choose for the study is guest house project located in urban area of New Delhi the study is done on the various topics like: time and cost relation, labour productivity, material selection, impact of wastage on cost overrun. Comparative analysis between the various material alternative options of method of construction these are the main factors which are considered as a study area of this research.

Project : Extension Hotel Blue Stone.  
 Area of building : 104.75 Sqm.  
 Location : Nehru place, New Delhi.  
 Estimated cost : 5964236.436/

**Figure no.1:** Typical 1-3th floor plan



**Table no.1** (General quantification of project RCC and Brick structure)

Item	Unit	QTY	RATE	AMOUNT
Excavation	Cum	124.72	181.85	22680.332
PCC	Cum	0.59	7738.2	4565.538
RCC	Cum	133.34	9400.85	1253509.339
Steel	kg	19132.49	77.89	1490229.646
Shuttering	Sqm	608	609.3	370454.4
Brick work	Cum	160.11	7809	1250298.99
Flooring	Sqm	95.56	1500.55	143392.558
Ceiling	Sqm	95.56	761.8	72797.608
Plaster	Sqm	907.08	307.9	279289.932
Plaster external	Sqm	272.44	266.85	72700.614
Paint	Sqm	1179.52	146.2	172445.824
Putty	Sqm	1179.52	115.15	135821.728
Door frame	Cum	2.235	130183.05	290959.1168
Door shutter	Sqm	64.8	1886.7	122258.16
Glazing	Sqm	87	3250.95	282832.65
				5964236.436 /-

Flooring	Sqm	95.56	1500.55	143392.558
Ceiling	Sqm	95.56	761.8	72797.608
Cement board (internal)	Sqm	907.08	1179.34	1069719.444
Cement board (external)	Sqm	272.44	1179.34	321288.492
Paint	Sqm	1179.52	146.2	172445.824
Putty	Sqm	1179.52	115.15	135821.728
Door frame	Cum	2.235	130183.05	290959.1168
Door shutter	Sqm	64.8	1886.7	122258.16
Glazing	Sqm	87	3250.95	282832.65
total cost				5781819.539/-

$$\begin{aligned} \text{Cost difference} &= 5964236.436 - 5781819.539 \\ &= 182,416.897/- \end{aligned}$$

The cost variation between LGFS and RCC is very small.

**Table no.2** General quantification of project LGSF System

Item	Unit	QTY	RATE	AMOUNT
Excavation	Cum	49	181.85	8910.65
PCC	Cum	0.24	7738.2	1857.168
RCC	Cum	20.4	9400.85	191777.345
LGFS channel	Cum	8462	217	1839638.8
Steel	kg	14280	79	1128120

**Table no.3** Comparative analysis

Factors	RCC and Brick structure	LGSF structure
Construction Quality street	It depends on the workers most or work done manually so the end product is inconsistent	It is Factory Controlled -End Product precision manufactured and assembled to very high tolerances using advanced techniques.
Entire Cycle Time	Entire Cycle Time depends on some uncontrolled factors like weather / material availability / local politics in procurement of Quarry material / Sand etc	All the material light in weight and dry it makes construction process faster. Thus a 5 storey building can be completed in a span of 5 months with better finishing
Labor Dependency	Totally Dependent, High Manpower required	Factory Controlled & Low manpower required.
Thermal Insulation	Lower index in terms of Thermal Insulation	Steel buildings are thermally insulated. Because there is gap between the wall panels it makes the building cool.
Load Component	Heavy dead loads – Foundation gets heavier	1/3 rd of the weight of conventional. – Optimization in Foundation Design.
Type of Erection Equipment needed	Manual Working	Mechanized Working
Portability to Remote / Hilly terrains	Very Difficult to procure materials ( brick – Sand – Coarse Aggregates in Remote areas )	Huge savings in transportation costs as LGSF construction is 1/3 weight of that of brick wall.
Erection	No scientific system available	All the materials are Part marked and are assembled as per the

		assembly process
Seepages and cracks	Once Seepage occurs – Entire wall has to be broken & repair done.	Only Localized area need be cut open, post repair area will be refitted neatly.

### 5. CONCLUSION

- Cost variation between LGFS and RCC is very small.
- For the cost of small structure or building LGFS is costly than the RCC but for mass level construction the overall cost is always less than the RCC. It depends on the scale of project.
- LGSF elements are factory made and directly transported to the site so don't need to procure these material on site.
- 5-10% is wastages at the construction site but by the using of these precast elements we can reduce the wastages and the cost.
- We can consider LGFS as sustainable material because all the steel material is recyclable.
- LGSF has good thermal performance due the cavity between the wall panels unlike the RCC and Brick buildings.
- LGFS contrition is faster than the RCC because 90% elements are precast we just need to assemble at the site.
- After all the benefits LGFS has some drawbacks like the social impact on people in India people are not mentally prepared for using LGFS.
- It is advisable to use of LGFS for commercial space, storage spaces and it is much faster to built offsite it has ability to adapt the future changes without producing non-hazardous and non- recyclable waste.
- So we can consider it as a sustainable approach to achieve the future demand of construction industry.

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